Moonshot Research and Development Program Goal 1 Kanai Project

IoB Minimally Invasive

IoB Minimally Invasive Technology
Intravascular Devices for Long-Term, High-Fidelity Neural Monitoring

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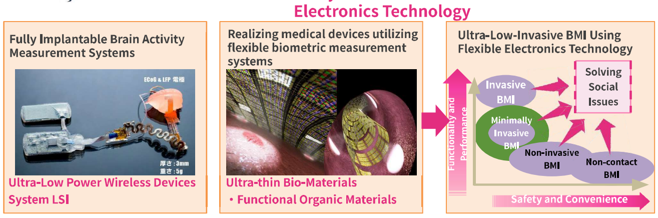
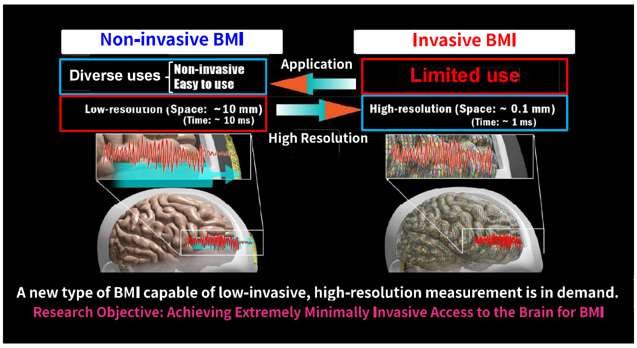
Overview

We are currently developing an intravascular brain–machine interface (intravascular BMI) that uses an ultra-thin film electrode device designed to be placed within cerebral veins near the cortical surface. The device can be inserted into intracranial veins using catheter-based endovascular procedures, enabling high-precision recording and stimulation of brain activity through the vessel wall. Positioned between invasive ECoG electrodes that require craniotomy and non-invasive scalp EEG, this technology represents a new platform for neural measurement and intervention that achieves both long-term signal stability and safety. Looking ahead, we envision it evolving into a next-generation IoB technology capable of enhancing human physical, cognitive, and sensory functions.

R&D 5: Realization of Minimally Invasive BMI

Development of an Intravascular EEG Recording System and an Ultra-Fine-Diameter Delivery Device Based on Ultra-Thin-Film Flexible Electronics Technology

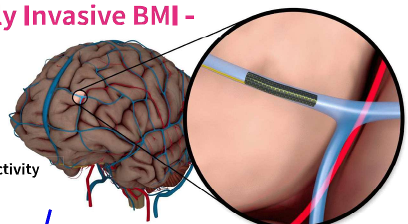


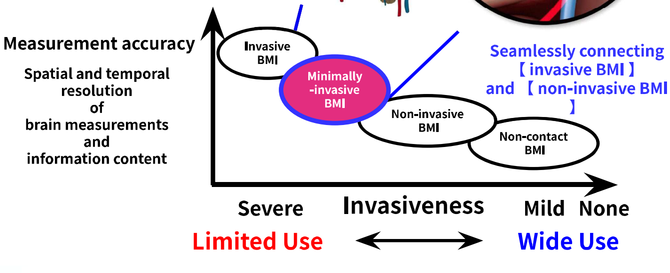


- Extremely Minimally Invasive BMI -

Ultra-Fine Soft Intravascular Device

Long-term measurement of brain activity from superficial cerebral veins





Two Devices for a Minimally Invasive BMI System

- Minimally Invasive BMI System Utilizing an Ultra-Fine, Flexible Intravascular Implant Device
- Intravascular EEG Measurement Device Serving as a BMI Signal Acquisition Platform

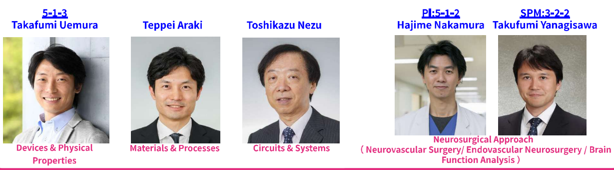
Research Structure

SANKEN University of Osaka

Graduate School of Medicine University of Osaka

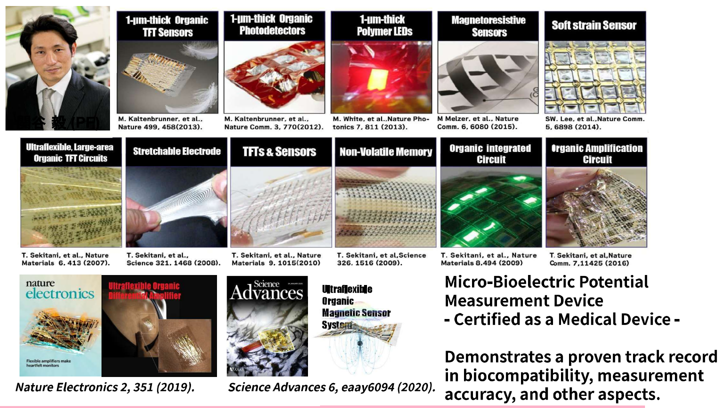
Ultra-Minute Flexible Intravascular Device for Minimally Invasive BMI System

Simultaneous Development of an Intravascular EEG Device Functioning as a BMI Transporter



Ultra-low invasiveness through thin-film electronics

Ultra-thin (1 μm), lightweight, flexible, stretchable sensors and integrated circuits (past achievements)

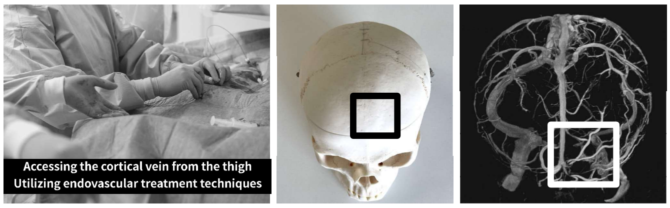


Micro-Bioelectric Potential Measurement Device
- Certified as a Medical Device -

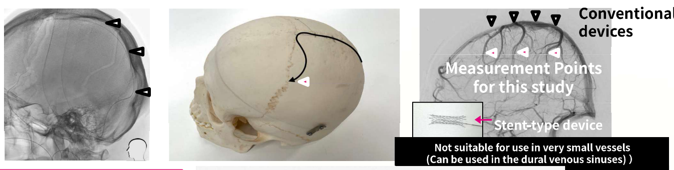
Demonstrates a proven track record in biocompatibility, measurement accuracy, and other aspects.

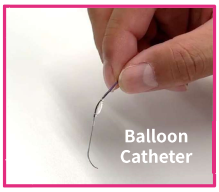
Access to the cortical veins running along the surface of the cerebrum is extremely difficult

Small vessel diameter, thin and fragile vessel walls, marked tortuosity



Because cortical veins are not protected by the dura mater, they are structurally vulnerable. However, their close proximity to the cortical surface makes them a promising target for minimally invasive intravascular devices capable of acquiring high-quality EEG signals.

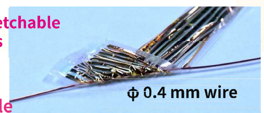


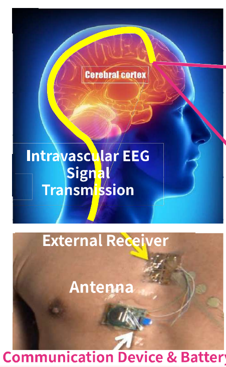


A sensor-equipped delivery device capable of transporting BMI to complex-shaped cerebral surface veins

- Guiding wire (φ<0.36mm)
- Guiding Catheter (φ<1mm)

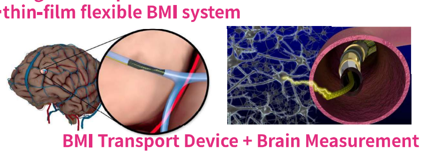
Ultra-thin, Flexible, Stretchable Electronics Applications





Communication Device & Battery

Long-term implantable thin-film flexible BMI system



BMI Transport Device + Brain Measurement

Enables extremely minimally invasive measurements and electrical stimulation

Current R&D Activities

Advancing Research and Development for High-Precision Intravascular EEG Measurement

- Development of Biocompatible Electrodes and Ultra-Thin-Film Sensor Probes
- Development of Intravascular Micro-Biological Signal Acquisition and Transmission Technologies

Internet of Brains

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